I respectfully submit these comments on the *Proposed Plan for Record of Decision Amendment* (EPA, June 2017) and the *Surface Water Technical Impracticability (TI) Evaluation Report* (Atlantic Richfield Company, September 2016) for the Anaconda Regional Water, Waste and Soils Operable Unit of the Anaconda Smelter NPL Site. By necessity, these comments also required reviewing the Final Vegetation Management Plan (Atlantic Richfield Company, May 2013). Having been party the TI evaluation and the earlier TI evaluation that culminated in the 2011 ROD Amendment as Montana DEQ's technical advisor, and having retired in July 2015, I have unique insight as a citizen advocate that I would like to share.

A TI evaluation and the subsequent decision to waive water quality standards is a complex, highly technical process that is often a necessary component of Superfund. The process requires finding pragmatic balance between protecting the environment, legally defined by meeting water quality standards, and determining the limits of what is truly achievable in an environmental cleanup.

There are real limits to what can be achieved and in many cases proposed remedy measures can be counterproductive, causing "unnecessary and potential irreparable harm to the environment for relatively low benefit." Foremost among counterproductive potential remedy elements in this TI are the proposed retention/detention basins that would replace highly functional riparian reaches where numerous beaver ponds are already reducing metal concentrations.

In the Proposed Plan, EPA and DEQ are proposing a cautious, step-wise approach toward waiving aquatic life standards. Cautious, because the proposed waivers are applied to a limited portion of the affected streams – only tributaries of upper Mill Creek and only upper Willow Creek. The waivers would not apply to mainstem Mill Creek, lower Willow Creek, California Creek, Warm Springs Creek or Lost Creek.

Step-wise because additional waivers are contingent on additional work – an "expanded and enhanced" remedy largely based on additional steep slope reclamation (SSR), storm water best management practices (BMPs) and constructing engineered retention/detention basins.

Although the Proposed Plan limits waivers at this time to Mill Creek tributaries and to upper Willow Creek, the TI Evaluation defined potential additional work elements in the remaining drainages and the Preferred Alternative holds out the requirement and promise that in the future, based on monitoring results "additional work and additional waivers will be considered."

The Proposed Plan and TI are a working framework for a rational path forward. However, detailed Remedial Design/Remedial Action (RDRA) work plans are not part of the Proposed Plan – those will be finalized in confidential consent decree negotiations.

My overriding concern – the success of SSR is speculative; the techniques and SSR program are poorly defined. The Proposed Plan defines a contingent remedy founded on a *wait and see what works* strategy.

The TI clearly defined the need to replace Montana's DEQ-7 standard for aquatic life, which is based on the total recoverable fraction, with the less protective Federal standard, which is based on the "dissolved" fraction. But the success of the Preferred Alternative rests on the Agencies and the Settling Defendants negotiating a balance between protecting the environment and defining what is technically practicable.

My comments and discussion focus on three major concerns with the Proposed Plan:

1. Beaver pond complexes versus engineered storm water ponds.
2. Steep slope reclamation.
3. Waiving standards – the need for biomonitoring.

Engineered Stormwater Ponds Versus Beaver Pond Complexes

The Preferred Alternative for storm water management includes potential retention/detention ponds, bioretention ponds, and wetland treatment as part of existing RDU work plans and the expanded and enhanced remedies proposed in the TI Evaluation Report. By most measures in the TI analysis, these are the remedy elements that will have the most direct and greatest effect on improving stream water quality. These engineered storm water structures replicate natural features - beaver ponds and associated wetlands – but are intended for urban settings, where maintenance is a part of normal municipal government function.

However, the engineered structures being proposed in the TI and RDU designs for upper Mill, Willow and California Creeks, are in remote areas outside of an urban corridor, and are in well vegetated undisturbed riparian zones. And in many cases the proposed structures would replace highly functional beaver pond complexes and would *likely cause unnecessary and potential irreparable harm to the environment for relatively low benefit*.

Contrary to the Proposed Plan and TI Evaluation Report, I propose that existing beaver pond complexes, and healthy riparian zones, be left undisturbed and not replaced by engineered structures. Where administratively practicable, beavers should be protected from trapping and possibly re-introduced in strategic tributaries and mainstem streams.

Using Joyner Creek as paradigm, it is easy to argue that replacing the extensive beaver pond wetland complex at the mouth of Joiner Creek with a single retention/detention pond as proposed in the RDU 15 Work Plan, would be counterproductive, less effective at removing COCs and an unnecessary cost (See Figure 1). It is in the aggregate of many small ponds, each surrounded by active, perennial wetlands, that beaver ponds complexes are superior to an engineered pond.

The numerous ponds in the lower half of Joyner Creek (Figure 2) provide greater storm surge equalization and sediment storage than a single engineered pond, but with the added benefit of effective wetland treatment and filtration through an expanse of decaying organic matter. In technical meetings the project design engineer made that same argument.

A common criticism of beaver ponds as remedy is that over time they fail. However, as a complex of linked ponds, failure of any single dam is inconsequential – the complex provides a natural form of redundancy. Additionally, beaver dams do not require maintenance and tend to become stable, long-lived structures over time. If beaver are managed to sustain adequate populations, the wetland complex they form will be self-sustaining and long lived.

Surface water monitoring and site characterization studies around beaver ponds in Cabbage Gulch, Joyner Gulch, Ceonothus Creek, California Creek and Muddy Creek have demonstrated that even a single pond effectively reduces COC and suspended sediment concentrations that eventually enter the mainstem streams. Montana Bureau of Mines and Geology found that a single pond could reduce copper loads by roughly 50 to 60% and total suspended sediment load by 40% (*Mt Haggin Storm-Water Report Data Summary Report* - MBMG for Montana Department of Justice 2014) and (Unpublished 2014 MBMG presentation *The Impacts of Beaver Ponds on discharge and Water Quality during Storm Events in Cabbage Gulch*).

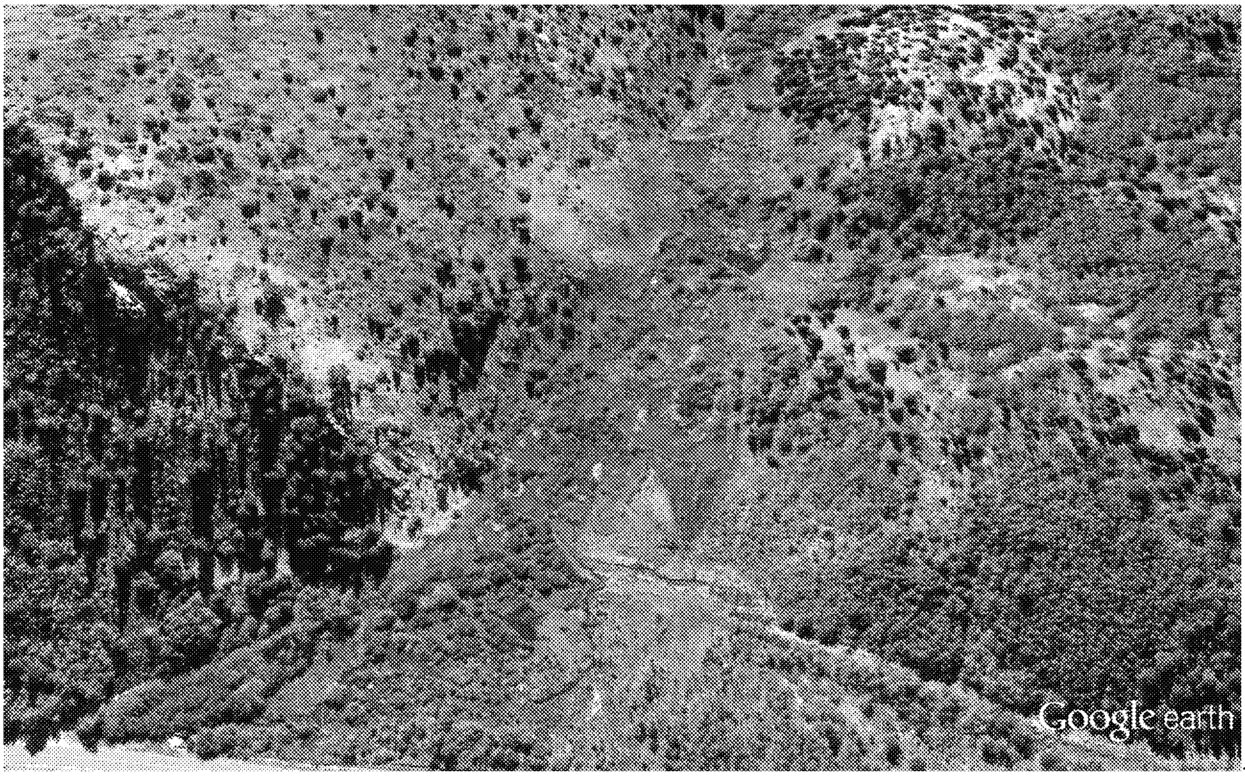

Figure 1. Mouth of Joyner Gulch where RDU work plans propose replacing a beaver pond and wetland complex with an engineered detention pond.

The Bureau also found that the "high prevalence of beaver activity in Cabbage Gulch, California Creek, Muddy Gulch, and Joiner Creek detains the stream stage response during storm events by up to 80%." And "in most instances, beaver dams detained discharge and muted stream stage response to storm water runoff to within diurnal variation."

Although not quantitative evidence, it is at least insturctive to compare the results presented in the TI Evaluation Report of both spring high flow (Figure 6-14) and storm event monitoring (Figure 6-24) between upper Ceonothus Creek (CC-6) and the mouth of Ceonothus (CC-9). Upper Ceonothus and the mouth are connected by a vibrant riparian ecosystem, complete with numerous beaver ponds. Figure 6-14 shows that during two spring synoptic sampling events (1995 and 2013), total recoverable copper exceeded the water quality standard by a factor of more than one. However, on the same days, after passing through numerous beaver ponds, Ceonothus Creek met DEQ-7 chronic standard at its mouth.

More impressively, comparing the same two stations during storm event monitoring (Figure 6-24), the upstream station exceeds the acute standard for total recoverable copper by factors ranging from 2 to approximately 20. Whereas at the mouth of Ceonothus, water quality tended to be well within meeting the standard.

Figure 2. Joyner Creek beaver ponds. Red markers denote beaver dam locations that are not currently active. Green markers indicate active beaver dam locations.

On a generic level, Montana Fish Wildlife and Parks recognizes these same benefits of beaver and beaver ponds when they state in their brochure *Living with Beaver* - "Beaver dams create wetlands that help control downstream flooding by storing and slowly releasing water, reducing the severity of high stream flows particularly after winter storms and spring snow melt. Wetlands also improve water quality by removing or transforming excess nutrients, trapping silt, binding and removing toxic chemicals and filtering out sediment." And just as important to a healthy fishery – "Beaver ponds store water and help maintain streamflow in drier months"

In a modeling evaluation of tributaries to the Big Hole watershed - *Beaver Habitat Suitability Model for the Big Hole Watershed* (DEQ, August 2011) author Stephan Carpenedo found that California Creek had high quality suitability for beaver community development.

In his introduction, Carpenedo summarizes the common understanding of the ecological benefits of beavers when he writes – "Beaver have long been known as ecosystem engineers that modify their environment to the benefit of both themselves and other species associated with the habitats they create. These benefits extend beyond fish and wildlife populations to the people living within the same watershed. Some of these include the retention of sediment, nutrient cycling and decomposition of organic material, flood peak de-synchronization, water storage and stream resiliency. One example of their benefit to people is their ability to store large amounts of sediment. Naiman et al. (1956) found that a small beaver dam could potentially retain up to 6500 cubic meters of sediment."

I assert that the most effective way to improve water quality and potentially meet standards for COCs in Mill, Willow and California Creeks is to establish institutional controls that would protect beaver populations by prohibiting trapping in targeted drainages. EPA in consultation with DEQ, should seek agreements with public land managers and private landowners in the Upper Mill and Willow and California Creek drainages to prohibit trapping. In Cabbage and Muddy Gulches, where beaver have likely been trapped out, it would be beneficial to reintroduce mating beaver pairs.

DEQ and NRD have worked extensively with private landowners and FWP to enhance CERCLA remedy, further restore riparian habitats and provide late season flows from tributaries in the upper Clark Fork basin. I suggest they collaborate with FWP on a beaver restoration program for the Mount Haggin Wildlife Management Area, which is administered by FWP and is the single biggest landholding affected by the proposed waivers.

The two other significant landholders, Amorex Land Company in the Mill Creek drainage and Butte Georgetown M & M Company in the California Creek drainage are private corporations that could be approached by NRD for legal agreements such as conservation easements.

Specifically, beaver populations should be maintained, encouraged or reintroduced in the following drainages:

Cabbage Gulch

Clear Creek

Joyner Creek

Ceonothus Creek

Hoodoo Creek

Andesite Creek

Muddy Creek

California Creek

As a final caveat, an effective beaver management plan would need to address managing nuisance beaver, where they interfere with irrigation or threaten roads or other infrastructure.

<u>Steep Slope Reclamation (SSR)</u>

The TI evaluation recognized the importance of expanding and enhancing the existing remedy for steep slope reclamation as these often barren, or sparsely vegetated areas are recognized as the main source of sediment and total recoverable COCs to Anaconda's streams. The connections between stable vegetation cover, erosion and stream sediment are intuitive. The connection between barren, steep slopes and exceedance of water quality standards during storm and snow-melt conditions is well documented and to some degree quantified in the TI evaluation.

However, reclaiming vast acreage of barren and poorly vegetated steep slopes, often in areas that are hard to access, has long been and remains a bugaboo at the Smelter Site. At this time there is a paucity of proven techniques. The exception is dozer basins, but those cannot be applied to very steep slopes.

The reclamation techniques established at ARWW&S for non-steep slopes rely on heavy equipment for tilling, fertilizing and seeding – those techniques have limited application or completely untenable on steep slopes.

The final Vegetation Management Plan (AR, 2013) defines a reclamation management program for non-steep slope reclamation that is founded on years of successful re-vegetation. It includes performance standards as defined by the Land Reclamation Evaluation System (LRES), a 10-year period of performance, long-term inspection and maintenance and a contingency of adding six inches of topsoil if performance standards have not been met after 10 years.

The VMP does not define vegetation performance standards for SSR and the contingency for non-steep slope reclamation does not apply to SSR. Instead of a vegetation performance standard, the VMP established a landscape stability (erodibility) performance standard based on the Bureau of Land Management Erosion Condition Classification System (Clark, 1980).

Specifically, the standard requires "a stability of less than or equal to 45." Additionally, areas where there is evidence of soil movement –solid deposition greater than 3 inches over more than 10% of the area, require maintenance. Areas exhibiting greater than 25% coarse fragment movement over more than 10% of the area require maintenance. Areas exhibiting rills greater than 2 inches deep and at intervals of 10 feet or less within the inspection area require maintenance (See Figure 3). All active gullies require maintenance. But maintenance is not practical in most steep slope areas because they are remote and have limited access.

It will be hard to get all stakeholders to agree to a program based on uncertain techniques, have an unspecified period of performance and may require long-term annual inspection and maintenance. The SSR program inferred by the Preferred Alternative and only partially defined by the VMP may prove to be impracticable.

I recommend a program based on <u>adaptive management</u>, a standard approach to environmental management where outcomes are uncertain. It's an iterative approach consisting of applying remedy, monitoring and evaluating outcomes, then applying effective remedy measures in the next iteration.

The program I suggest consists of testing SSR techniques annually on demonstration areas. The amount of work required each year could be set by acreage or cost. Three years after a demonstration area is completed it should be evaluated for effectiveness.

At each five-year review, the SSR program should be evaluated and revised as necessary. With a better understanding effective SSR and its limitation, the revisions might include revised performance standards and contingencies. With a better understanding of what is achievable on steep slopes, it may be more effective to establish a vegetation performance standard and discard the slope stability standard. A greater than or equal to 20% vegetative coverage has been suggested elsewhere.

Figure 3. Steep slopes in upper Joyner Creek with erosion rills.

The final remedial design/remedial action work plan, which will be attached to the consent decree for the site, will need a specific plan and program for SSR including a performance schedule. The period of performance should be specified by a number of three year cycles and an evaluation of the effectiveness of continuing or terminating the program.

The RD/RA work plan or CD will likely include language allowing the PRPs to request management mediation to determine if the polygon(s) in question can be moved beyond the active stage without meeting performance standards.

The Montana Natural Resource Damage Program has conducted several steep slope reclamation and erosion BMPs demonstrations in Cabbage Gulch and California Creek drainages. Those demonstrations have included some heavy equipment work where it was feasible, but have also demonstrated hand work. Assessing the effectiveness of those demonstration should be the first step in a long-term program.

As required by the VMP, SSR designs, monitoring and evaluations must be overseen and performed by qualified ecologists or reclamation scientists. To the extent practicable, the vegetation should consist of local native species, including grasses, shrubs and trees to conform to the ROD ARARs and to a strategy to establish self-sustaining vegetative cover.

Waiving DEQ-7 Standard – Need for Additional Monitoring.

The TI clearly defined the need to waive aquatic life standards. Montana's DEQ-7 hardness based standard for the metals, which uses the total recoverable fraction, will be replaced with the less protective Federal hardness based standard, which uses the "dissolved" fraction. The specific waive-to standard for copper is vague and warrants additional discussion below. Montana's standards are being waived under federal CERCLA jurisdiction, with Montana DEQ consent. It is a site-specific waiver that only applies to the four ARWW&S streams.

Throughout Montana, under state jurisdiction, DEQ-7 still applies. Montana has a well-founded rationale for maintaining the more protective total recoverable standard. The total recoverable fraction consists of both metals attached to suspended sediment and dissolved metals. EPA has been unable to develop water quality criteria for contaminated sediments and has made little progress since publishing the draft *Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Potential Approaches* (EPA, August 2003).

The state still recognizes that contaminated sediment likely affects aquatic life through diet and the food chain. Waiving the total recoverable fraction leaves Montana without the tools to regulate contaminated sediment and raises the need to expand the current USGS water quality monitoring program to include both bed sediment biological monitoring.

Silver Bow Creek and the Clark Fork have long-term biomonitoring and bed sediment monitoring programs in place that should be incorporated into the long-term monitoring plan for ARWW&S. The programs consist of the following monitoring elements:

- Aquatic insect diversity coupled with biotic indices conducted by consultants (Rhithron, Dan McGuire)
- Aquatic insect metal body burden targeting hydropsyche conducted by USGS (Michele Hornberger)
- Fish population surveys conducted by FWP
- Caged fish studies conducted by FWP
- Fish tissue studies conducted by FWP
- Bed sediment conducted by USGS and consultants (Respec)

In addition to these suggested monitoring components, synoptic water quality monitoring events should be included in the program in preparation for the five-year reviews. Synoptic monitoring, conducted during spring runoff, should be used to gauge the effectiveness of remedy.

The Proposed Plan infers that copper standards will be a special case. According to Exhibit 4 of the Proposed Plan – the waived-to standard *will be determined under the forthcoming Surface Water Management Plan*. Apparently the Agencies are considering two options. As with the other COCs, they may require a hardness based standard, using the dissolved fraction. But they are likely also considering the Biotic Ligand Model (BLM). The EPA recognizes the BLM based standard for copper and only copper. It has not been adopted by any state, but is used selectively in some states on a site-specific basis.

The BLM is an empirically based model used to examine the bioavailability of copper in the aquatic environment and the affinity of copper to accumulate on gill surfaces of organisms that at some concentration has a toxic effect. The model uses the specific stream chemistry at the time a sample is collected to derive both chronic and acute standards.

There is some uncertainty that the acute BLM standard is protective. The acute standard is applied to storm events, when aquatic life can endure higher concentrations for a short interval.

It would be prudent for the Agencies to take a cautious approach to selecting the copper standard and require the hardness and dissolved based standard be written into the forthcoming Surface Water Management Plan. They should hold out the BLM until it is further validated with a well-established biomonitoring dataset.